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METHOD FOR THE MANUFACTURE OF A STABLE BEVERAGE USING A FRUIT JUICE AS A RAW MATERIAL

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METHOD FOR THE MANUFACTURE OF A STABLE BEVERAGE USING A FRUIT JUICE AS A RAW MATERIAL

[Kaju o genryo to suru antei na inryo no seizoho]

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Claim

A method for the manufacture of a stable beverage using a fruit juice as a raw material characterized by the fact that a fruit juice obtained by filtration with an ultrafiltration membrane having a fractionation molecular weight in the range of 3,000-20,000 is used.

Detailed explanation of the invention

The present invention relates to a method for the manufacture of a stable beverage using a fruit juice as a raw material. The objective is to provide a method for the manufacture of a beverage having long-term quality stability and being extremely high in commercial product value.

The beverage using a fruit juice as a raw material mentioned in the present invention refers to all beverages containing fruit juices. For example, fruit beverages, beverages containing less than 10 % fruit juice (including that for dilution), carbonated beverages with introduction of fruit juice, lactic acid bacteria beverages with introduction of fruit juice (including that for dilution), soybean milk beverages with introduction of fruit juice, and so on are available.

Conventionally, the raw material fruit juices for use in the beverages mentioned previously are classified into the turbid form and the transparent form. For the former, a secondary precipitation phenomenon occurs immediately in the beverages containing a large amount of microfine pulpy and colloidal substances owing to the so-called fruit-squeezed juices. In particular, in the case of bottled beverages, they are not used to a large extent because of a poor appearance, a decrease in the commercial product value, and other reasons. In the case in which beverages with good quality and stability are desired, the latter transparent fruit juices have been used. These transparent fruit juices are obtained by the addition of a clarifying agent (gelatin, tannin, pectin decomposition enzyme preparation or the like) into fruit squeezed juices to form agglomerated precipitates or enzyme decomposition precipitates, followed by filtration. By mixing saccharides, acid-flavoring materials, fermented milk, carbon dioxide, perfume, coloring matter, water and so on into these transparent fruit juices, beverages using fruit juices as raw materials can be manufactured. For the conventional beverages using fruit juices as raw materials manufactured in this manner, there are many problems to be solved as described in the following. It has been desired to develop a practical manufacturing method.

θ For milk beverage with introduction of fruit juice, lactic acid bacteria beverage with introduction of fruit juice and so on, by the mixing of fruit juice and acidic milk, milk protein combines with pectin, tannin, polyphenol or the like in the fruit juice and an agglomeration precipitation phenomenon occurs rapidly. As methods for the prevention of this, there are (a) a method for the addition of a natural stabilizer (pectin, gelatin, gum or the like) or a synthetic adhesive paste (alginic acid propylene glycol ester, methyl cellulose, carboxy methyl cellulose or the like) to make a protective colloid for milk protein to prevent the agglomeration precipitation, (b) a method for removing pectin or tannin in fruit juice as much as possible with a pectin decomposition enzyme preparation or gelatin, (c) a method for the addition of a milk protein aqueous solution into fruit juice beforehand to remove pectin, polyphenol and tannin that react with milk protein, and so on.

However, in the case of (a), the viscosity of the beverage is high and the cooling feeling is lacking. In the case of (b), the enzyme decomposition may be insufficient or it has a disadvantage of having insufficient filtration like in the case (c).

ω In the case of transparent fruit beverages and transparent carbonated beverages with the introduction of fruit juices, if the conventional transparent fruit juices are used as raw materials,

the secondary precipitation phenomenon caused by components (pectin, protein, starch, polyphenol, neutral polysaccharides (arabinogalactan) and so on) in fruit juices will occur during long-term storage. Conventionally, for the removal of these secondary precipitates, a removal method by the addition of a pectin decomposition enzyme preparation, gelatin, bentonite or the like is available. This is used alone or in combination. However, a method for the complete removal of the precipitate substances formed has not been proposed.

ε In transparent fruit juices, an unpleasant odor (a taro odor) unique to fruit juices exists. This unpleasant odor is increased by long-term storage. The flavor is deteriorated and the commercial product value is decreased. It is said that this is caused by the oxidation by polyphenol oxidase or the heating during fruit juice squeezing, the amino carbonyl reaction, etc. Conventionally, an adsorption method with activated carbon or the like has been tried. However, there is a problem in the adsorption capacity and it has not reached popularity in practical use.

ρ In the filtration method carried out during the manufacture of transparent fruit juices, in many cases, a filtration aid (diatomaceous earth, asbestos or the like) is added. By passage through the layer formed with the filtration aid, a transparent fruit juice is obtained. The average passage diameter is usually 2-5 microns. Microfine substances, such as pectin decomposition materials, the filtration aid, enzyme residues and so on pass through and enter the beverage. This is the cause of the occurrence of the secondary precipitation.

τ In the case of milk beverages with the introduction of fruit juices and milk type carbonated beverages with the introduction of fruit juices, a foaming phenomenon caused by milk protein and fruit juice components occurs during manufacturing. This causes difficulty in charging. Conventionally, the temperature during charging is kept as low as possible without freezing it and charging is carried out. A cooling apparatus is required. Cooling time is required, and problems occur in terms of the equipment and the capacity.

ψ As a characteristic of grape beverages, the crystal deposition of tartar occurs during storage. Its complete removal is difficult. It mixes in the beverage and becomes the cause of the secondary precipitation.

As a result of zealous investigations on the method for the manufacture of a stable beverage using a fruit juice as a raw material in order to solve problems like these, the inventors have accomplished the present invention with remarkable effectiveness. In other words, the present invention provides a method for the manufacture of a stable beverage characterized by the fact that a fruit juice obtained by filtration with an ultrafiltration membrane having a fractionation molecular weight in the range of 3,000-20,000 is used.

The present invention will be explained in detail in the following.

First of all, various fruit juices as raw materials are subjected to filtration using an ultrafiltration membrane of a fractionation molecular weight in the range of 3,000-20,000 in a transparent form, a translucent form or a turbid form, preferably a transparent form.

The types of raw material fruit juices that can be used in the present invention include all squeezed juices of Onshu oranges, summer oranges, Barensha [transliteration] oranges, lemon, lime, grapefruits and other citrus fruits, apples, grapes, peaches, strawberries, pineapples, melons, plums, pation [transliteration] fruits, cherries, black currant [transliteration], tomatoes and other edible fruits.

In the present invention, it is essential that a fruit juice is filtered by using an ultrafiltration membrane and that an ultrafiltration membrane with a fractionation molecular weight in the range of 3,000-20,000 is used. Through these measures, the conventional technological problems described previously can be solved extremely easily, and stable beverage can be obtained.

If the fractionation molecular weight is more than 20,000, since pectin, protein, polyphenol, high molecular weight tannin and so on remain in the fruit juice, the quality and stability of the beverage will deteriorate and its commercial product value will decrease. Furthermore, if the fractionation molecular weight is less than 3,000, the original taste-exhibiting components of the fruit juice are also removed. At the same time, the operation requiring a high pressure in filtration due to the osmotic pressure will be difficult. A deterioration of the fruit juice due to heat evolution will also occur.

In regard to the material for the ultrafiltration membrane, a membrane made of any material commonly used as an ultrafiltration membrane can be used. However, a cellulose type membrane, a polyfluorine type membrane, a polymethyl methacrylate membrane and so on are preferred.

As the ultrafiltration apparatus, an apparatus of any modular structure can be used. The tubular module, the spiral module, the hollow fiber type module and so on can be used. The ultrafiltration is conducted generally under the conditions of 20-70°C and less than 10 kg/cm^2 or so.

If the fruit juice obtained in this manner is mixed with a saccharide, an acid-flavoring material, fermented milk, carbon dioxide, a perfume, a coloring matter, water and so on, if desired, according to an ordinary beverage manufacturing recipe, in order to manufacture a beverage using a fruit juice as a raw material, a stable beverage exhibiting remarkable effects as shown in the following can be obtained.

The agglomeration precipitation of fruit juice and protein is minimized and long-term stability is possible.

Pectin substances and high molecular weight tannin substances are removed and the occurrence of the secondary precipitation in the beverage is extremely rare.

The taro odor and other characteristic unpleasant odors of the fruit juice and brown coloring matters are removed, and a beverage with a good flavor can be obtained.

Microfine substances, enzyme agent residues and other conventional filtration leakage components are removed, and the occurrence of the secondary precipitation in the beverage is extremely rare.

The foaming components caused by the fruit juice are removed and even if foaming occurs, it disappears immediately.

In the case of a beverage with the introduction of a grape fruit juice, tartar n the fruit juice is removed and precipitate formation in the beverage is extremely rare.

In particular, when the method of the present invention is applied appropriately to a transparent fruit juice obtained by a clarifying agent treatment and this treated fruit juice is used in the manufacture of a milk type beverage, lactic acid bacteria beverage or the like, its stabilizing effect and so on are even more pronounced.

The present invention will be explained with application examples in the following. However, these application examples do not restrict the present invention in any way.

Application Example 1

Carbonated beverage with introduction of a fruit juice (fruit juice 10 %)

1850 g of a lemon transparent fruit juice were filtered under a pressure of 0.3 kg/cm^2 G by using a hollow fiber type ultrafiltration apparatus (filter area 1.15 m^2 and fraction molecular weight about 4,000) made of polymethyl methacrylate. In 1 h, 1717 g of a lemon transparent fruit juice were obtained. With the following blending, a carbonated beverage with introduction of a fruit juice (fruit juice 10 %) was manufactured.

	w/w
Lemon transparent fruit juice obtained by the method described previously	10 %
Sugar	5 %
Glucose-fructose liquid saccharide (Bx 75°)	6.5 %
Perfume	0.1 %
Treated water	3.4 %
Subtotal (syrup)	25 %
Carbonated water	75 %
	w/w
Total	100.0 %

The above blended material was sterilized at 80°C for 30 min. The gas pressure of the product was 2.0 kg/cm^2 (20°C).

As a result of the comparison between the present beverage and a comparative product using the conventional lemon transparent fruit juice, (1) for the present beverage, the secondary precipitate was in an extremely minute amount (the secondary precipitate was observed clearly to a large extent for the comparative product) as shown from the following results in the severance test at 45°C for 2 months.

Secondary precipitate measuring method

The beverage after the severity test (at 45°C for 2 months in a constant-temperature vessel) was shaken well for homogenization and about 50 mL of it was collected in an ADMI centrifugal precipitation tube with graduations. It was centrifugally separated at a rotational radius of 14.5 cm and 3,000 rpm for 10 min. After natural settling, the supernatant was discarded carefully, and about 50 mL of the beverage were added again. Centrifugal separation was conducted under the same conditions. Furthermore, this operation was repeated 3-4 times. The total amount of the precipitate in 200 mL of the beverage (one juice bottle) was determined.

Results

	Precipitate amount (per 200 mL)
Present beverage	Less than 0.01 mL
Comparative product	0.06 mL

Furthermore, for the present beverage, the browning phenomenon of the beverage occurred rarely and the return of the color was slow in tests (2) and (3), and the foaming phenomenon was minimal carbon dioxide blowing in and during charging.

Application Example 2

Milk type carbonated beverage with introduction of a fruit juice (fruit juice 10%)

A 1/5 Onshu orange transparent fruit juice was filtered under a pressure of 3.5 kg/cm^2 G by using an ultrafiltration apparatus (fraction molecular weight about 10,000) made of polyvinylidene fluoride. The filtration rate was 7 L/m^2/h. The 1/5 Onshu orange transparent fruit juice obtained here was blended in the following manner to yield a milk type carbonated beverage with introduction of a fruit juice (fruit juice 10%).

	w/w
1/5 Onshu orange transparent fruit juice obtained by the	

method described previously	2 %
Sugar	10 %
Sterilized lactic acid bacterium beverage	10 %
Citric acid (crystals)	0.05 %
Perfume	0.1 %
Treated water	2.85 %
Subtotal (syrup)	25 %
Carbonated water	75 %
	w/w
Total	100.0 %

The above syrup was blended. After homogenization at a pressure of 150 kg/cm^2 G, carbonated water was charged and sterilized at 80°C for 30 min. The gas pressure of the product was 2.0 kg/cm^2 (20°C).

As a result of the comparison between the present beverage and a product manufactured with the conventional 1/5 Onshu orange transparent fruit juice (an addition product of 0.4 % pectin as a stabilizing agent in the previously mentioned blend), (1) for the present beverage, the agglomeration precipitation of protein did not occur even without the addition of the stabilizing agent. Furthermore, (2) its viscosity was low, it was easily drinkable, and the cooling feeling was good. (3) Foaming during charging was small and the operating efficiency was good.

Application Example 3

Carbonated beverage with introduction of a fruit juice (fruit juice 30%)

90 L of a 1/5 apple transparent fruit juice were filtered under a pressure of 2.6 kg/cm^2 G by using a tubular type ultrafiltration apparatus (filter area 0.6 m^2 and fraction molecular weight about 10,000) made of polyvinylidene fluoride. At a filtration rate of 8 L/m^2/h, 70 L of a 1/5 apple transparent fruit juice were obtained. By using this fruit juice, a carbonated beverage with introduction of a fruit juice (fruit juice 30%) was manufactured.

	w/w
1/5 apple transparent fruit juice obtained by the method described previously	6 %
Sugar	4 %
Glucose-fructose liquid saccharide (Bx 75°)	5.5 %
dl-Malic acid	0.2 %
Sodium citrate	0.03 %
Perfume	0.1 %

Treated water	9.17 %
Subtotal (syrup)	25 %
Carbonated water	75 %
	w/w
Total	100.0 %

The above blend was sterilized at 80°C for 30 min. The gas pressure of the product was 2.0 kg/cm^2 (20°C).

As a result of the comparison of the present beverage with a comparative product using the conventional 1/5 apple transparent fruit juice, (1) the secondary precipitate was in a very minute amount (the secondary precipitate was observed clearly to a large extent for the comparative product) in the severity test at 45°C for 2 months. The results obtained by the determination of the precipitate by the secondary precipitate measurement method in the same manner as in (1) in Application Example 1 are shown in the following.

	Precipitate amount (per 200 mL)
Present beverage	0.02 mL
Comparative product	0.20 mL

Furthermore, for the present beverage, (2) the unpleasant odor (taro odor) of the fruit juice disappeared, the perfume-rendering effect by the perfume was high, and the flavor was good. In addition, the browning phenomenon of the beverage occurred rarely and the return of the color was slow in tests (3) and (1), and the foaming phenomenon was small during carbon dioxide blowing in and during charging in (4).

Application Example 4

Milk type carbonated beverage with introduction of a fruit juice (fruit juice 10%)

677 g of an Onshu orange fruit juice turbid straight were filtered under a pressure of 1 kg/cm^2 G by using a hollow fiber type ultrafiltration apparatus (filter area 1.15 m^2 and fraction molecular weight about 4,000) made of polymethyl methacrylate. In 1.2 h, 425 g of an Onshu orange transparent fruit juice were obtained. With this fruit juice as the raw material and according to the following blending, a milk type carbonated beverage with introduction of a fruit juice was manufactured.

w/w

Onshu orange transparent fruit juice described previously	10 %
Sugar	10 %
Fermented milk	2 %
Perfume	0.1 %
Treated water	2.9 %
Subtotal (syrup)	25 %
Carbonated water	75 %
	w/w
Total	100.0 %

The syrup was blended. After homogenization at a pressure of 150 kg/cm^2 G, carbonated water was charged and sterilized at 80°C for 30 min. The gas pressure of the product was 1.8 kg/cm^2 (20°C).

In the comparison between the present beverage and a beverage manufactured with the conventional Onshu orange transparent fruit juice (an addition product of 0.4% pectin as a stabilizing agent), (1) for the present beverage, the agglomeration precipitation of protein did not occur even without the addition of the stabilizing agent. Furthermore, (2) its viscosity was low, it was easily drinkable, and the cooling feeling was exhibited well. (3) Foaming during charging was small and the operating efficiency was good.

Application Example 5

Lactic acid bacteria beverage with introduction of a fruit juice for dilution (fruit juice 10% when diluted 5 times)

350 g of a 1/5 grape transparent fruit juice were filtered under a pressure of 3.5 kg/cm^2 G by using a polysulfone type ultrafiltration apparatus (a flat membrane test apparatus, filter area 0.0038 m^2 and fraction molecular weight about 15,000). In 2 h, 315 g of a 1/5 grape transparent fruit juice were obtained. With this fruit juice as the raw material and according to the following blending, a lactic acid bacteria beverage with introduction of a fruit juice for dilution (fruit juice 10% when diluted 5 times) was manufactured.

	w/w
1/5 Grape transparent fruit juice obtained by the method described previously	10 %
Sugar	50 %
Fermented milk	20 %

Citric acid (crystals)	0.2 %
Perfume	0.4 %
Treated water	19.4 %
	w/w
Total	100.0 %

The above was blended. After homogenization at a pressure of 150 kg/cm^2 G, it was sterilized at 80°C for 30 min.

In the comparison between the present beverage and a beverage manufactured with the conventional 1/5 grape transparent fruit juice (an addition product of 0.4 % alginic acid propylene glycol ester (a synthetic adhesive paste) as a stabilizing agent), for the present beverage, (1) the agglomeration precipitation of protein did not occur even without the addition of the stabilizing agent. Furthermore, (2) there was no secondary precipitation due to tartar in long-term storage either, and (3) its flavor was good, its viscosity was low, and it was easily drinkable.